

Memorandum

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To: MR. CHRISTOPHER LE
Senior Transportation Engineer
Design B
District 12

Date: July 31, 2018
File: 12-ORA-5 PM-17.8 to 19.7
12-0M980 (1213000084)
El Toro Undercrossing

Attention: Ms. Yenhai Nguyen

From: **GAMINI WEERATUNGA**
DIVISION OF ENGINEERING SERVICES
Geotechnical Services
Office of Geotechnical Design South
Branch C

Subject: District Preliminary Geotechnical Report for Interstate 5/El Toro Interchange, Orange County, California.

The Office of Geotechnical Design South (OGDS) prepared this memorandum with preliminary geotechnical recommendations for the proposed improvements to Interstate 5/ El Toro Interchange. At this stage of the project, 4 build alternatives have been selected for further study and evaluation.

This memorandum was prepared in response to a request on June 27th, 2018, by Design B of District 12 for preliminary geotechnical recommendations for the preparation of the Draft Environmental Document. Consequently, the evaluations and recommendations provided in this report were made based on existing information of the subsurface and topographic conditions and a review of geologic maps of the area and therefore should be considered preliminary.

Existing Facilities and the Proposed Project

District indicated that a separate project is underway to widen Interstate 5 (I-5) at the subject location. As a result of that project, at the subject site, I-5 will have five general purpose lanes, one auxiliary lane, and two High Occupancy Vehicle lanes in each direction prior to implementation of the improvements proposed in this project. The interchange has 6 on- and off-ramps, 3 each in northbound (NB) and southbound (SB) directions.

The existing interchange structure is a 2-span box girder bridge with reinforced concrete open-end diaphragm abutments and a 12-column bent. The bridge was originally constructed in 1969 as two separate structures (left and right bridges) that were widened in 1996. The 1996 widening consisted of adding a minimum of 10 feet to the exterior of the right bridge, a minimum of 13.5 feet to the exterior of the left bridge and closing the gap between the two bridges. The abutments of the original structures and the widened portions are supported on 16-inch diameter cast-in-drilled-hole (CIDH) piles and the bents are founded on shallow

footings. The original bent foundations consist of 11-foot square, shallow footings. The construction plans indicate that the bent footings of the widenings are of variable sizes.

The request letter dated June 27th, 2018 indicate that 4 build alternatives are being considered for the improvement. It further states that all alternatives may require construction of new sound walls and retaining walls.

The alternatives presented in the request letter are as follows.

Alternative 1: Intersection Modification

Alternative 2: Flyover

Alternative 3: Diverging Diamond Interchange

Alternative 4: Southbound Collector- Distributor and Hook ramps

Regional Geology

The project is located within the Peninsular Ranges geomorphic province at the northeast edge of the San Joaquin Hills. The project area is mapped as Quaternary very old alluvial fan deposits with Quaternary young alluvium to the south of the bridge, and Miocene-aged Monterey Formation to the west and north, as well as underlying the project area.

Site Subsurface Soil Conditions

The site subsurface conditions were determined by the logs of test borings (LOTB) prepared for the original bridge construction and the subsequent widening. The LOTBs developed in 1967 and 1992 for these constructions indicate that the site subsurface materials consist of artificial fill placed for the construction of I-5 embankment including approach fills, and the underlying native soils. The artificial fill at the bridge approaches is present from an elevation of about 360 feet to the top of I-5 embankment at an approximate elevation of 380 feet. The fill consists mainly of granular materials with varying amounts of clays and silts. The apparent density of the fill ranges from medium dense to very dense. Terrace Deposits and alluvium underlying the fill, also consist of granular soils with clays and silts that are predominantly dense. Terrace Deposits and alluvium are underlain by claystone/siltstone units of Monterey Formation from Elevations 339 feet and 352 feet downwards.

Groundwater

Groundwater was encountered at a depth of 44 feet below ground surface (Elevation 337 feet) during the 1992 geotechnical investigation.

No wells with historic data were located within 1 mile of the site on the California Department of Water Resources Water Data Library website.

The State Water Resources Control Board Geotracker website listed many sites near the El Toro UC. The most recent monitoring records from gas stations to the northeast and southwest of El Toro Rd UC show that the groundwater elevation is higher in the northeast (maximum of 368.16 feet on 11/14/2016) and the gradient flows to the southwest (maximum of 345.69 feet on 11/29/17). However, even though the groundwater elevation is higher to the northeast, the depth to groundwater is shallower in the southwest due to the change in ground surface elevation over the area. Depth to groundwater is between approximately 15-20 feet to the northeast, and it is between 10-15 feet in the southwest.

A site-specific groundwater investigation will be conducted during the design phase of the project to determine the depth to groundwater at the site.

The project is not expected to affect the existing groundwater regime.

Faulting and Seismicity

The site is located in seismically active southern California and is subject to shaking from several nearby faults. Fault parameters for the three most significant faults near the subject site are summarized in Table 1.

Table 1 - Faults Parameters

Fault Name	Fault ID	M_{max}	Type	Dip Degrees	Dip Direction	R_{rup} (miles)	R_{JB} (miles)	R_x (miles)
San Joaquin Hills	376	7.0	Rev	23	W	1.3	0	0.4
Newport Inglewood fault zone (S. Los Angeles section-southern)	366	7.2	SS	90	V	7.2	7.2	7.2
Newport-Inglewood (Offshore)	381	6.9	SS	90	V	9.0	9.0	9.0

Ground Motion

The three faults listed in Table 1 are capable of generating strong ground motion in the project area. The Design ground motion is governed by the deterministic analysis, which calculates a Peak Ground Acceleration (PGA) of 0.619g.

Ground Rupture

No active and potentially active faults are known to transverse the project area or the vicinity. The project site is not located near any mapped Special Studies Zone or within 1000 feet of a historically active unzoned fault. Therefore, the risk of ground surface fault rupture is considered to be low.

Seismic Hazards

The site is not located within a zone mapped by the California Geological Survey as being prone to liquefaction or seismically induced landslides. The groundwater was encountered in 1992 investigation, in potentially non-liquefiable bedrock materials. However, if groundwater levels have risen since the 1992 investigation (based on the higher levels observed in investigations for nearby constructions) then the potential for liquefaction may exist. Due to the relatively flat terrain at the site, the consequences of liquefaction would be mainly limited to seismically induced settlements. Although, the embankments could experiences seismically induced lateral deformations depending on the depth, areal extent and the post-liquefaction residual strength of the potentially liquefiable layers, OGDS is of the opinion that such deformations would be minor.

The potential for liquefaction and its consequences, if any, should be evaluated based on the geotechnical investigation to be performed for the proposed project.

Conceptual Geotechnical Recommendations

Based on the information available from 1967 and 1992 investigations, OGDS preliminarily recommends pile foundations for structures like the flyover considered in one of the alternatives. Retaining walls and sound walls, if proposed, could be founded on shallow footings. Pile foundations for the walls may be necessary, if space constraints or other issues preclude the use of shallow footings. Due to high PGA expected at the site, special designs may be needed for the retaining walls.

OGDS anticipate only minor removals of surficial materials at locations receiving fill (approximately 1 to 2 feet) and moderate overexcavations (on the order of 3 to 5 feet below the footing bottom levels) at the locations of proposed shallow foundations.

The proposed improvements are not anticipated to increase the seismically induced hazards as they will be designed and constructed in compliance with the current Caltrans Seismic Design Criteria and Standards.

It should be noted that the above geotechnical recommendations are preliminary and are intended for the use in environmental documents only. Any needed remedial grading

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(overexcavations) will be evaluated by OGDS based on a site specific geotechnical investigation with drilling and sampling of borings. The structure/foundation types and configurations will be determined by the Office of Structure Design in concurrence with OGDS following the geotechnical investigation.

Please contact Gamini Weeratunga at (657) 328-6592 of the Office of Geotechnical Design-South, Branch C for questions on the comments.

Prepared by Date: 07/31/2018



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OGDS Project File